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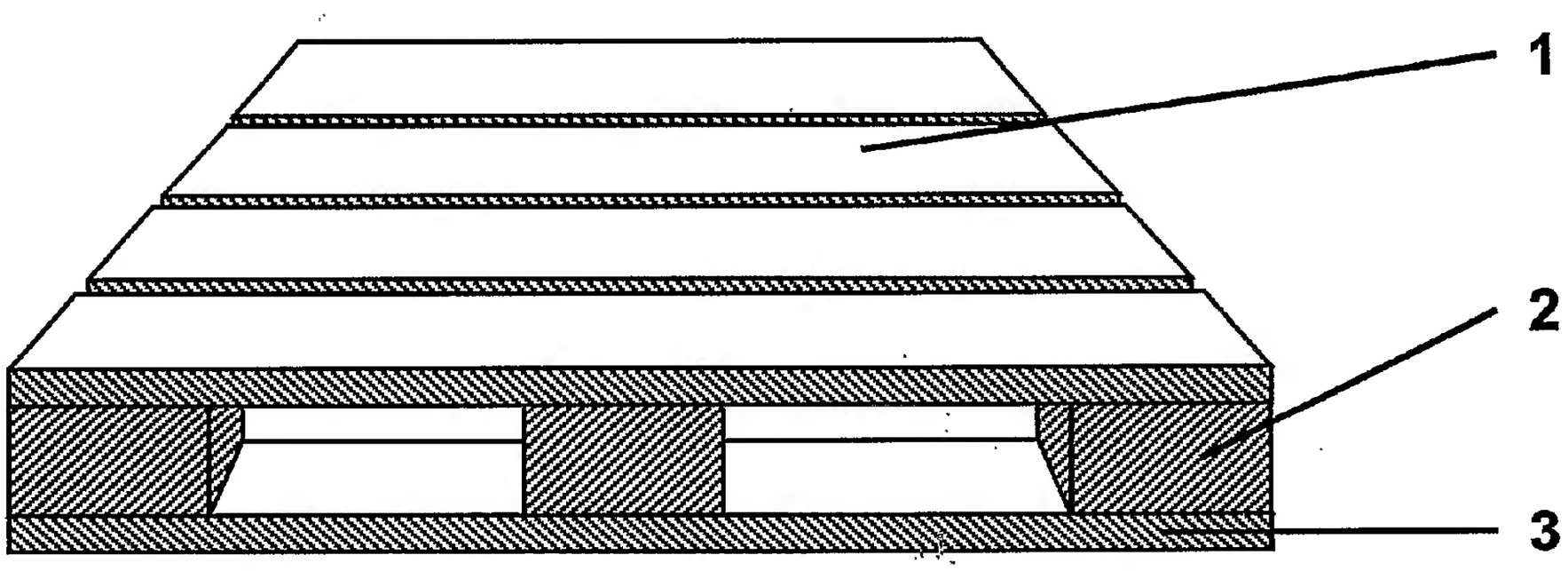
(54) Title: PALLETS AND PARTS THEREOF



(57) **Abstract:** The majority of manufactured goods, are shipped from the manufacturing plant either direct to the end customer or to shopping outlets. Transportation of such goods is eased, by packaging them on wooden pallets which can readily be moved by means of a pallet truck. These wooden pallets, however, suffer from significant problems associated with the hygroscopic nature of the wood, in particular where the supports for holding the pallet platform off the floor with enough clearance to allow the pallet truck access. Exposure to water causes the wood to soften and weaken, which results in the pallets being more susceptible to damage during regular handling. In order to overcome such issues, a plastic composite material is presented which can readily be incorporated into the wooden pallets, which does not have a hygroscopic nature. This material is particularly advantageous as it can be formed into any desired shape, and has similar physical properties to wood.

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Pallets and Parts Thereof

This invention relates to improvements in design and materials used in wooden pallets for use in the packing and transporting of goods industries.

Background to the Invention.

The vast majority of manufactured goods are packaged and transported on pallets of variable size, depending upon the individual requirements of both the product and user. Such pallets provide a solid base onto which goods can be loaded, while further providing a structure which can be handled with standard moving equipment. The use of pallets not only allows for many small items to be packaged and carried in one convenient unit, but further provides a level of protection for the goods as they are supported away from the ground and do not come into contact with the lifting and moving equipment.

Pallets are typically made from wood, for several reasons: wood, as a material, is readily fashioned into the necessary parts to make up a pallet and can easily be assembled. It exhibits the necessary strength for carrying and transporting even large and heavy equipment, whilst further being a relatively inexpensive raw material. Typically, the pallet will comprise a top surface constructed from a plurality of parallel slats, which are fastened to underlying perpendicularly aligned support structures. These underlying structures may simply be further slats used to fix the base slats in place; or, they may be large blocks running the length of the pallet, which are used to support the platform away from the ground and give the necessary clearance to allow the lifting equipment underneath. Other designs for the pallet supports, have spacer blocks separating two sets of platform slats by the necessary amount to allow the lifting equipment access. A further option, is to use spacer blocks separating the platform slats from a pallet base, wherein the spacer blocks are located such that the lifting truck can access and lift the pallet from any side.

Wooden pallets, however, are possessed of certain undesirable properties which will tend to limit their usable lifetime. Of primary concern, is that wood is a hygroscopic material: prolonged exposure to rain and moisture in the atmosphere causes the wood to absorb

water, which eventually leads to the wood rotting. Moreover, when the wood in the pallets becomes wet, it swells and becomes soft, which reduces the overall strength of the pallet and can lead to failure. As a further problem, when the pallet is too wet, the wood does not grip the nails holding it together with enough force, which can lead to the pallet falling apart, or not being able to withstand impacts. Finally, there is the problem that when the wooden pallets sit on the ground for prolonged periods of time, the hygroscopic nature of the wooden feet, combined with capillary action, will transfer moisture from the ground up to the goods sitting on the pallet.

It is not uncommon for the pallet feet to be constructed from a combination of wood shavings and a urea based resin, rather than from cut timber blocks, the two being combined and the wooden blocks moulded under high pressure. Unfortunately, this urea resin is poisonous, and the fumes which are generated when the old unusable pallets are burned, are also toxic. Further, such composite feet are less resilient to water than pure timber, tending to expand greatly upon exposure to moisture. Once in this expanded state, the feet are more greatly susceptible to damage from being knocked or from being in contact with the forks of the pallet truck.

One route that has been employed to overcome these limitations, is to construct the pallets from plastic. In general, the pallet is injection moulded as a single piece, and the full pallet is realised in one moulding. Clearly, plastic pallets do not suffer from the same problems induced by exposure to water, as detailed above for wooden pallets. The manufacture of full plastic pallets, however, requires very large plastic injection moulding machines, as these pallets can be larger than 1m to a side. Coupling this with the cost of the plastic, means that full plastic pallets, whilst desirable, are often too expensive for the end user.

Summary of the Invention.

In order to overcome the above problems associated with water damaging the materials used in the current technology, an improved material and method for producing the same is presented in the independent product and method claims.

A pallet spacer made from a composite plastic material is presented, wherein the plastic comprises a mixture of an elastomeric substance and a thermoplastic binder. The plastic material has an internal elasticity as a result of the elastomeric substance, which acts to generate a radial gripping force; such a gripping force could act to grip the shaft of a nail which was located therein.

Such a pallet spacer is formed from the plastic material by following the steps of: melting the thermoplastic material and combining this with the elastomeric substance; mixing the thermoplastic material and elastomeric material in an extruder; injection moulding the composite material into a pre-designed mould and allowing the composite to cool to form the solid structure.

Further embodiments of the present invention are defined in the dependent claims.

Description of the figures.

Figure 1 shows a packaging pallet with composite material spacers integrated into the design.

Detailed Embodiment of one Way of Implementing the Invention.

This invention discusses a new composite thermoplastic and elastomeric material and method of manufacture and use thereof, for improving the lifetime and water resistant properties of packaging pallets. Crucially, this material can be integrated with traditional methods of pallet construction, being used as a straight replacement for wooden components.

Specifically, the current invention is directed toward incorporating the new plastic material within traditional wooden pallets, by replacing at least some of the wooden components. This is made possible by virtue of the method of manufacture of the plastic pieces, which allows for fabrication of any shape or design. A further component, is the internal structure of the composite, which shows a degree of elasticity that radially grips the shaft of a nail being used to fasten together the constituent parts of a pallet. Moreover, as the plastic composite does not exhibit the hygroscopic properties of wood, it is not degraded by prolonged exposure to water, and so can substantially lengthen the lifetime of the pallets. As a further benefit of this, the composite prevents the development of insect eggs and maggots as the humidity within the material is very low; this is particularly advantageous with regard to the import and export of wooden products, and the increasing necessity to certify the wood as insect and larvae free.

Figure 1 shows one possible embodiment of integrating the new material within a pallet. The traditional wooden spacers positioned underneath the pallet platform (1), which are used to provide the ground clearance to allow for pallet truck access, have been replaced with spacers (2) fabricated from the plastic composite. In this example, the spacers (2) have been

fabricated as simple blocks which are located between the platform (1) and the pallet base (3). It should be noted though, that any design for the spacers (2) or base supports is possible, and that the simple blocks shown in the figure are for illustration only. Any structure that can be conceived and formed from wood can readily be duplicated by the plastic composite. Indeed, it is possible to fabricate an entire pallet from the composite, either as a single formed unit, or by producing individual parts and fixing together as in the case of wooden pallets.

As stated above, the plastic composite is formed from a combination of both a thermoplastic material and an elastomeric material. The combination of these two substances, is what gives the composite its wood-like properties. Suitable thermoplastic materials are any of the range of polyolefins, for example polyethylene or polypropylene, ethyl vinyl acetate (EVA) or thermoplastics such as: polyurethane or polyvinylchloride (PVC), or other suitable substances such as any of the range of polyamides. A key advantage of using a polyolefin, however, is that it can be obtained from scrap and waste plastic, such as old detergent bottles, thereby reducing costs. Any elastomeric compound, such as natural rubber or a synthetic substitute, is appropriate for incorporation within the thermoplastic; once again, recovered waste materials from industries such as tyre or shoe manufacturing provide a suitable supply, at negligible cost.

Production of the composite structures, is by injection moulding of the two constituent materials from an extruder. The elastomer is ground up into small fragments, lying somewhere in the range of 0.1 to 5mm in size, and is combined with the melted thermoplastic in the extruder. The operating temperature at this stage is carefully chosen, to ensure that the thermoplastic is in a molten state when it is mixed with the elastomer, but the elastomer remains a solid. Injection moulding of this mixture into whatever shaped mould is required, then ensures that the elastomeric compound is uniformly distributed throughout the thermoplastic binder.

It is the combination of the two different compounds which gives the plastic composite its desired and useful physical properties. After cooling, the thermoplastic binder gives a rigidity to the composite and a hard outer shell, which confers the required resistance to shock impact and allows it to be used as a replacement for wood. By virtue of the elastomer being combined with the thermoplastic as a solid in its natural cross-linked or vulcanised state, so as to create a suspension, the composite is endowed with an internal elasticity. This elasticity is vital, as it both allows nails to be hammered into the material, as well as subsequently providing a radial compression which grips the shaft of the nail, holding it in place. It is this combination of the more rigid thermoplastic polymer with the elastic elastomer which creates

the final composite having similar physical properties to wood, without the drawbacks of a hygroscopic nature and the subsequent problems associated with this.

The ratio of thermoplastic to elastomeric materials within the composite, can be adjusted to change the physical properties of the final material. These properties include, but are not limited to: density, surface hardness and internal elasticity (how tightly the composite grips a nail). For example, a plastic block comprising entirely thermoplastic material with no elastomer provides a very hard structure, however, it is too hard to allow the insertion of a nail and therefore cannot be incorporated within a wooden pallet. Likewise, if too much elastomer is used, the resulting structure is rather too soft and does not show the required rigidity or resistance to impacts. Depending upon individual user requirements, the percentage by volume composition of the composite can range from an elastomer composition of between 15-80%. For use as spacers (2) within a pallet, however, the ratio by volume composition preferably lies between 50:50 to 40:60, thermoplastic : elastomer, which gives the desired wood-like physical properties. Changing this composition ratio will change the density of the final material, and additionally the radial gripping force applied to the shaft of a nail therein. It is possible to select the composition such that the "pool out" or "pull out" force, which is the force required to be applied to a nail held in the material so as to remove it, lies between ~500N and ~2500N. For use in pallets, however, it is most desirable to have a minimum force requirement of 700N, to ensure that the pallet can withstand normal usage. The actual density, and therefore pool out force property, can be chosen by the end user, and may be selected on the basis of the equipment being used by the client for pallet manufacture, and the specific capabilities of this.

A key advantage to the composite, is that there is no requirement for using particularly high quality raw materials. As has been stated, both the elastomer and the thermoplastic can be obtained as scrap or waste material from other industries, household refuse collections or as films co-extruded from multilayered plastic materials. Furthermore, any compound with elastomeric properties is suitable for the elastomer, the only requirement being that the compound remains as a solid during the mixing and extruding step with the thermoplastic. Suitable materials, in addition to natural rubber as detailed above, which have been shown to combine effectively into the composite include glass fibres and indeed wood shavings themselves. As the thermoplastic completely surrounds the elastomer within the composite, the desired water resistant properties are unaffected by the choice of material. It is also unnecessary to use only one compound as the elastomer, it is possible to use a mixture of any suitable substances, as it is primarily the ratio of elastomer to thermoplastic content that gives the composite its final physical properties.

As the composite can be formulated with physical properties which very much match those of wood, it can be treated as such when incorporated within structures. This is particularly advantageous when integrated into a pallet or other wooden structure, as it means that it can be fixed simply by the use of nails. Clearly, not having to provide further fixing mechanisms, such as bolts or screws through the composite, dramatically improves its usability and allows for simple and quick fixing within such structures.

As the composite material and final products are created with injection moulding, it is clear that any structure can be fabricated, and as previously detailed this can include a full pallet. There are significant benefits to be gained, however, by producing smaller components and using the advantageous physical properties and relative ease of fixing to construct a final product. Initially, the production of smaller items by injection moulding requires smaller moulds, which in turn requires smaller machines; both of these factors help to keep the associated costs low. Secondly, there is the necessity of removing the heat from the molten thermoplastic, which clearly takes longer the larger the structure. As such, smaller items can be fabricated more cheaply and with a higher rate of production, than larger single moulded products.

Just as the initial thermoplastic material can be coloured when it is used for its initial purpose, prior to being discarded and melted down to be used in the composite, it is possible to add pigmentation to the composite material. Indeed, the process of injection moulding will yield a product which has an outer surface that is primarily composed of the thermoplastic, with the elastomer uniformly distributed throughout the interior. As such, it is clear that the use of a coloured plastic or standard pigmentation within the thermoplastic melt will give a coloured final product.

Whilst the discussion herein has been limited to the integration of the composite material in packaging pallets, it will be clear to the person skilled in the art, that the specific properties of this material make it suitable for a wide variety of tasks. As this composite has very similar physical properties to wood, with the further advantage that it can be injection moulded into any desired configuration, it can be adapted to be incorporated into any situation or construction where wood is used and a resistance to water damage and seepage is required.

Claims

1. A pallet spacer (2) made from a composite plastic material comprising a mixture of an elastomeric substance and a thermoplastic binder, wherein,
the material has an internal elasticity as a result of the elastomeric substance, which provides a means for generating a radial gripping force; such a gripping force could act to grip the shaft of a nail located within the material.

2. The pallet spacer (2) of claim 1, wherein,
the elastomeric substance is held with the thermoplastic binder in a substantially vulcanised or cross-linked state.

3. The pallet spacer (2) of claims 1 or 2, wherein,
the elastomeric substance is in the form of small pieces lying in the region of 0.1 to 5mm in size.

4. The pallet spacer (2) of any of the preceding claims, wherein,
the elastomeric substance is uniformly distributed throughout the thermoplastic binder.

5. The pallet spacer (2) of any of the preceding claims, wherein,
the elastomeric substance is any one of natural rubber, glass fibre or wood.

6. The pallet spacer (2) of claims 1 or 2, wherein,
the thermoplastic is any one of the polyolefins such as: polyethylene or polypropylene, ethyl vinyl acetate (EVA) or thermoplastics such as: polyurethane or polyvinylchloride (PVC) or a polyamide.

7. The pallet spacer (2) of any of the preceding claims, wherein,
both the elastomeric substance and the thermoplastic binder are obtained as waste materials from household collection or other industries and are recycled into the composite.

8. The pallet spacer (2) of any of the preceding claims, wherein,
the plastic material has a substantially rigid structure and a hard outer shell.

9. The pallet spacer (2) of any of the preceding claims, wherein,
the plastic material is non-hygroscopic.

10. The pallet spacer (2) of any of the preceding claims, wherein, the pool out force required to be applied to the shaft of a nail located within the plastic material so as to remove it from the material, lies between 500 and 2500 Newtons, with the force required to remove the nail from, or drive the nail into the plastic material being dependent upon the composition of the plastic material.

11. The pallet spacer (2) of claim 10, wherein, the pool out force required to be applied to the shaft of a nail located within the plastic material so as to remove it from the material, is at least 700 Newtons.

12. The pallet spacer (2) of any of the preceding claims, wherein, the physical properties of density, surface hardness and radial grip on nails is a result of the ratio of elastomeric substance to thermoplastic.

13. The pallet spacer (2) of claim 11, wherein, the percentage by volume of elastomer in the composite plastic material lies in the range 15-80%.

14. The pallet spacer (2) of claim 12, wherein, the percentage by volume of elastomer in the composite plastic material preferably lies in the range 40-60%.

15. The pallet spacer (2) of any of the preceding claims, wherein, the colour of the material can be selected.

16. The pallet spacer (2) of any of the preceding claims, wherein, the shape of the spacer (2) can be selected to be any form.

17. A method for creating the pallet spacer (2) of any of the preceding claims, comprising the steps of:
melting the thermoplastic material and combining this with the elastomeric substance;
mixing the thermoplastic material and elastomeric material in an extruder;
injection moulding the composite material into a pre-designed mould and allowing the composite to cool to form the solid structure.

18. The method of claim 17, wherein, the temperature required to melt the thermoplastic is lower than that required to melt

the elastomeric substance so maintaining the elastomeric substance in a substantially vulcanised or cross-linked state.

19. The method of claims 17 and 18, wherein,
the elastomeric substance is pre-ground into small pieces lying in the size range of 0.1 to 5mm.

20. The method of claims 17-19, wherein,
the step of injection moulding the mixture leads to the elastomeric substance being uniformly distributed throughout the thermoplastic binder.

21. The method of claims 17-20, wherein,
the thermoplastic is chosen from any one of the polyolefins such as: polyethylene or polypropylene, ethyl vinyl acetate (EVA) or thermoplastic such as: polyurethane or polyvinylchloride (PVC), or a polyamide.

22. The method of claims 17-21, wherein,
the elastomeric substance is chosen from any one of natural rubber, glass fibre or wood.

23. The method of claims 17-22, wherein,
the resultant physical properties of hardness, density and internal elasticity of the resultant composite are selectable by varying the ratio of elastomeric substance to thermoplastic.

24. The method of claims 17-23, wherein,
the percentage by volume of elastomer in the composite plastic material lies in the range 15-80%.

25. The method of claim 24, wherein,
the percentage by volume of elastomer in the composite plastic material preferably lies in the range 40-60%.

26. The method of claims 17-25, further comprising the steps of:
integrating the formed structures into wooden packaging pallets to create pallets with improved water resistant properties.

27. The method of claim 26, wherein,
the pallet spacer (2) is integrated into wooden structures by using nails.

28. The method of claims 17-25, wherein,
there are a plurality of pre-designed moulds which are shaped so as to create a plurality of different formed structures, which can be used to create a packaging pallet made entirely from the composite plastic.

29. The method of claim 28, wherein,
one of the pre-designed moulds is that of a packaging pallet and the final structure is a single piece moulded packaging pallet.

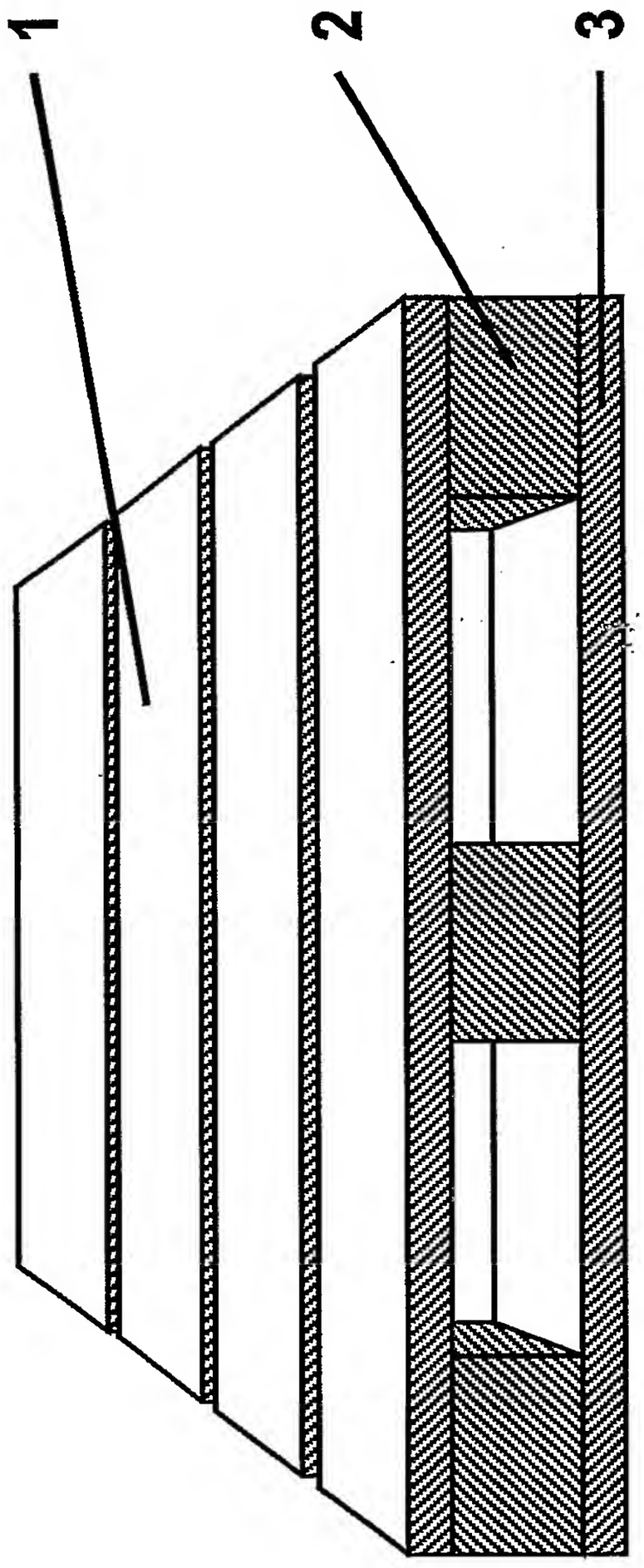

Figure 1

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/000214

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 40 583 A1 (BERTOLD, PETER, 7823 BONNDORF, DE) 29 April 1993 (1993-04-29) column 2, line 4 - line 10 column 2, line 26 - line 65 column 3, line 21 - line 23 column 3, line 33 - line 37 column 3, line 56 - line 59 column 4, line 23 - line 26 column 7, line 66 - column 8, line 6 figure 1	1-29
X	WO 02/34631 A (SOCIETE D'ETUDE DE GESTION D'INVESTISSEMENT ET DE; MULLER, PATRICK) 2 May 2002 (2002-05-02) page 3, line 16 - line 30 page 6, line 20 - page 7, line 7	1-9, 15-23,29

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 September 2005	22/09/2005

Name and mailing address of the ISA
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Authorized officer
Appelt, L

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/000214

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2005/000214

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			EP	0023070 A1	28-01-1981
			JP	56020039 A	25-02-1981

DERWENT-ACC-NO: 2006-513406

DERWENT-WEEK: 200652

TITLE: Pallet spacer for transporting industrial component, has composite plastic material with internal elasticity as result of elastomeric substance, which provides gripping force, which acts to grip shaft of nail located in plastic material

INVENTOR: MONDON, F

PATENT-ASSIGNEE: YELLOWSTONE INT LTD[YELLN]

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WO 2006074691 A1	July 20, 2006	E	015	B65D 019/00

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APPLICATION-DATA:

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ABSTRACTED-PUB-NO: WO2006074691A

BASIC-ABSTRACT:

NOVELTY - The pallet spacer (2) is formed using a composite plastic material comprising a mixture of an elastomeric substance and a thermoplastic binder. The composite plastic material has an internal elasticity as a result of the elastomeric substance, which provides a radial gripping force. The gripping force acts to grip the shaft of a nail located within the composite plastic material.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for method for creating the pallet spacer.

USE - For packing and transporting of industrial components from manufacturing plant to end customer or shopping outlet.

ADVANTAGE - Transportation of industrial components is easily enabled by packaging on pallets, which is readily moved by pallet trucks. The composite plastic material is advantageous compared to wooden pallets by absence of hygroscopic nature, and by having desired shape.

DESCRIPTION OF DRAWING(S) - The figure shows the packaging pallet with composite material spacers integrated into the design.

Pallet platform 1

Pallet spacer 2

Pallet base 3

CHOSEN-DRAWING: Dwg.1/1

TITLE-TERMS: PALLET SPACE TRANSPORT INDUSTRIAL COMPONENT COMPOSITE PLASTIC MATERIAL INTERNAL ELASTIC RESULT ELASTOMER SUBSTANCE GRIP FORCE ACT GRIP SHAFT NAIL LOCATE PLASTIC MATERIAL

DERWENT-CLASS: A92 Q32

CPI-CODES: A12-P06B;

ENHANCED-POLYMER-INDEXING: Polymer Index [1.1] 2004 ; R00326 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D82 ; R00835 G0566 G0022 D01 D11 D10 D12 D51 D53 D58 D63 D84 F41 F89 ; H0022 H0011 ; H0317 ; P1150 ; P1310

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Polymer Index [1.3] 2004 ; P1592*R F77 D01 ; H0317

Polymer Index [1.4] 2004 ; R00964 G0044 G0033 G0022 D01 D02 D12 D10 D51 D53 D58 D83 ; R00338 G0544 G0022 D01 D12 D10 D51 D53 D58 D69 D82 Cl 7A ; H0000 ; H0317 ; P1150 ; P1796 P1809 ; P1343

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